

WITH THE WRITER'S COMPLIMENTS.

THE
SYSTEM OF SEWAGE DISPOSAL
—IN—
BERLIN, GERMANY.

AN OBJECT-LESSON FOR SOME AMERICAN MUNICI-
PALITIES.

By WALTER WYMAN, M. D., Surgeon U. S. Marine Hospital Service.

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The new system of sewerage in Berlin was begun in 1870, was developed gradually, has been fairly in operation for eight years and now includes seven of the twelve districts into which the city has been divided for sewerage purposes.

The plan contemplates in each district a pumping station, where all the sewage of the district is received and pumped thence to the irrigation fields, some twelve or fifteen miles distant. Seven pumping stations have been established, but five only are in actual use. The irrigation fields or *rieselfelder* are four in number, three only being utilized, and are located to the north, north-west, south and south-east of the city. The four fields contain 5,500 hektares, or 14,666 acres of land.

For more minute details than are contemplated in this paper, the reader is referred to the following works published in Berlin:

- 1.—“Canalisation of Berlin,” by James Hobrecht, published by Ernst & Korn, with plates.
- 2.—“Statistisches Jahrbuch der Stadt Berlin for 1882, Von Richard Bockt.” Gives financial statistics.
- 3.—“Verwaltungs-Bericht des Magistrats zu Berlin,

April 1, 1883 to March 31, 1884." For economic reports, chemical analysis, etc.

It will serve the present purpose, however, simply to give such facts and impressions as I personally received during a day spent in visiting the pumping stations and the fields. Being kindly furnished with a letter from Consul General M. S. Brewer, I was shown every attention at the office of the Director General, where the system was explained by means of diagrams, and an officer subsequently detailed to accompany me to one of the pumping stations.

Of the two stations visited, it will be more interesting to describe the one which operates the drainage from the most central section of Berlin, viz: the third section, which includes the Unter den Linden with its palaces, and a densely populated commercial district as well. This station is the oldest, though not the largest of the five now in use. One might suppose that its location would be in some out of the way place, but we were surprised to find it in a desirable portion of the city not specially removed from other buildings and only a three minutes walk from one of the finest railway stations in Europe—the Anhalter Bahnhof. The buildings, grounds and brick fence had a neat and orderly appearance, not unlike that of a well-conducted manufactory.

In the yard I was first shown the large cistern or *sandfang* into which is poured, and through which is strained the sewage of the whole district—sewage of all kinds with the flush and rain waters. The district, or section No. 3, has a population of 130,000 and the quantity of sewage pumped here (in fluid state of course) is about 16,000 cubic metres every twenty-four hours. On Saturdays the quantity is increased to 20,000 or 30,000 cubic metres.

It requires but an hour and a-half or two hours for all excrementa and other sewage to get from the place of deposit to this sandfang, and so great is the quantity of water that by the time the cistern is reached the excrementa are in thorough solution. The water dilutes and

renders them inoffensive and they are pumped out of the way before putrefaction begins. It has been shown that in 500 cubic metres of the fluid there is one cubic metre of solid matter, and in fact this fluidity of the sewage and its very rapid removal seem to be the two features which make this system successful.

The sandfang or cistern has a capacity of about 5,000 cubic metres, its dimensions being five metres in depth and twelve metres in diameter; its location is but a few yards distant from a busy street, and not more than twenty steps removed from the front entrance of the local manager's residence. It is loosely covered with boards an inch or more apart, and upon stepping upon the platform we failed to notice any odor. No sickness has been caused by it either in the residence or among the laborers. Occasionally, though not often, it is necessary to flush it with water.

An attendant raised a few of the planks to give us a view of the contents. It appeared about half full of simply a muddy looking fluid, a bucketful of which was hauled up and emptied back to show that it was liquid only, and without stench. The canal opening was visible through which the fluid was discharging into the cistern with a good current. The opening is elliptical in shape, its longest and horizontal diameter measuring 3.40 metres, and its shortest or vertical diameter 2.90 metres. The fluid is not pumped directly from this cistern but has to pass into a suction pit some thirty or forty feet nearer to the engines. The outflow channel has the same capacity as the one just mentioned but its mouth is on a higher level and differs too in shape, being imperfectly elliptical, with the longest diameter vertical instead of horizontal.

Between the two openings and dividing the cistern into two equal parts is an iron grating or strainer, the bars of which are perpendicular and two centimetres apart, and serve to catch paper, rags, etc., which are scraped out every day or two and burned in the boilers. The fluid thus strained passes into the suction pit just

mentioned, where there are six cylinders or suckers operated by the six engines of the station. The pit was opened for our inspection, and though the fluid was in agitation there was no odor. Connected with the pit is an overflow for use when the rainfall is so great that the engines are unable to pump off as rapidly as the fluid collects from the sewers—which event happens twelve or fifteen times a year, with about an hour's duration each time. The overflow discharges into the river Spree, a small stream that flows through Berlin in two or three branches. We were next shown into the boiler-room containing six boilers, and into the adjoining engine-room with the same number of engines. The latter room is 75x45 feet and is handsomely finished. The engines run day and night (for it will be remembered that there is no detention of the sewage at the station), one engine being held always in reserve. There are gauges in this room showing the height of the fluid in the sewers and sand-fang, and the amount of pumping to be done can be estimated.

Having thus learned how the sewage is collected and disposed of at the pumping stations, we were now prepared to observe the other half of the system, viz: its transmittal through the pipes or *druckleitung* to the *rieselfelder* or irrigation fields.

Taking the cars at the Anhalter Bahnhof a ride of twenty minutes brought us to the village of Lichtenfelde, the nearest railway station to the *rieselfelder*, which are about three miles distant. Lichtenfelde is a country place of ordinary appearance, with nothing about it to indicate the proximity of any nuisance. The country round about is as level as an Illinois prairie.

As we approached the fields on foot (we were unable to get a conveyance) our *alæ nasorum* were elevated to an angle of expectant attention and three Schneiderian membranes were on the *qui vive* to condemn the first polluted zephyr from the suspicious territory about to be explored, but there was no zephyr of the kind aforesaid. Presently we were on the borders of the fields and made our way

to a small collection of houses called Osdorf, inhabited by laborers, etc., with their families, to the number of about one hundred people. Finding the main building and office, our permit insured us polite attention and a demonstration with diagram of the method of sewage distribution and disposal of the surplus water.

On going into the fields after first noting the absence of odor, (and the day was mild) our next surprise was the entire absence of machinery. The pumping force of the engines in Berlin is sufficient to throw the fluid to two central distributing points through channels measuring respectively one metre, and seventy-five centimetres in diameter. From these two central points distributing pipes radiate in every direction for a certain distance, connecting with the open courses or ditches which extend through the fields. At the point of junction of the pipes with the ditches, valves are provided for regulating the flow.

There is no reservoir in the *rieselfelder*, the sewage being distributed as fast as it is received. But it sometimes happens that the valves of a number of distribution pipes are closed and at the same time an unusual amount of pumping is required at the station in Berlin, thus causing a sudden excess of sewage. To relieve this, at each of the two central points just named there is erected a stand-pipe provided at the top with an overflow which discharges into neighboring shallow basins, sixteen in number. These stand-pipes, with their covering, have the appearance of small towers, their tops being twenty-one metres above the level of the city. The plain around Berlin is thirty or forty feet above the city level, and these pipes themselves are about thirty feet above the level of the plain.

A watchman is constantly on duty at each tower to give notice of an overflow by means of a bugle, calling upon the workmen to open all the valves. An automatic arrangement gives the same notice by means of a flag, or at night, a lantern.

The fields over which we were looking contain 5,000

morgen or 3,333 acres; one *morgen* being two-thirds of an acre. They receive the sewage from sections 1, 2 and 3 of the twelve sections into which Berlin is divided. Five thousand cubic metres of liquid are distributed into them every twenty-four hours, of which 25 per cent. remains as deposit and 75 per cent. flows off as water. We were informed that for every 500 persons, there is required about four *morgen* of land or $2\frac{2}{3}$ acres, and that the area of irrigation land required is about one and a-half times the surface of the city drained. The fields are very level and divided off with some degree of regularity by avenues lined with small trees, and further by ditches and furrows, giving to the whole a tessellated appearance. The sections are of two general sizes, the larger called meadows, being used for raising grass, and the smaller called beds, for the growth of vegetables.

We inspected a particular meadow containing about four acres, and questioned a laborer at work on one of its ditches. It had been flooded four days before and was to be flooded again the following day. Its soil appeared simply dark and moist; a ditch surrounded it, two feet in width and one and a-half feet in depth, through which the sewage fluid was slowly running. The current was made stronger, indeed quite forcible, by turning a valve at one corner of the meadow where the open ditch connects with the distribution pipe. To flood the meadow the current is put on at full force and the surrounding ditch opened at various points on the meadow side. This particular meadow gave five cuttings of grass last summer. We saw others that had just been flooded having the appearance of shallow ponds. About three days time is required for the disappearance of the water.

Besides grass, rye, oats, wheat, hemp and corn are raised; and in the beds, sugar beets, carrots, turnips, cabbage and chicory. Cows are pastured in the fields and are all healthy. The laborer, who has been employed here for five years, asserted that there is no sickness common among the workmen, except rheumatism, caused

by working on moist ground—that sometimes in the summer strangers complain of the odor but the workmen never. The odor is chiefly experienced in the morning when the stop valves are opened, allowing the exit of gas that has accumulated in the pipes during the night. This passes off after the fluid runs a few moments. There is some stench also when the ditches are cleaned out, as they must be occasionally.

The remaining point to be explained is the method by which these beds and meadows are prevented from becoming marsh-like and soggy, in other words the drainage. They are all underlaid by porous drain tiles placed one or more metres below the surface. Where the soil is sandy the tiles are about seven metres apart; where it partakes more of the nature of clay they are but three metres apart. The water collects in the tiles, runs into receiving ducts which empty into a main ditch. This ditch discharges into a small stream that flows into the river Havel, near Potsdam. As Potsdam is the summer seat of royalty, and the Emperor's summer palace 'Babelsberg' is located directly on the Havel, the statement may be more readily believed that the water discharging into the Havel is clear, inoffensive and free from deleterious matter.

As to the cost of this system, my information is, that the canalisation and other preparation of the five sections of Berlin in which it is employed, cost the sum of 34,598,405 marks or \$8,600,000; while the *rieselfelder* or irrigation fields cost the city for 4,835 hektares or 12,894 acres, the sum of 10,763,460 marks or about \$2,690,865. Some idea of the yearly running and casual expenses may be obtained from the expense of the third section for the fiscal year ended April 1st, 1884, which was 124,191 marks or \$31,047. This section, the one we inspected, contains 3,002 buildings and a population of 130,000. If the proportion of houses to inhabitants appears small to an American, the universal custom of living in apartments or flats must be remembered. The houses are correspondingly large.

The following statement is from the Jahrbuch for 1882 (published in 1884):

Expenditures for the Five Sections for Five Quarters or one and one-quarter years.

The five sections contained 10,549 buildings.

A.—Cost of Pumping Stations, Salaries, etc., 111,666 marks; Running Expenses, 257,512 marks, of which 161,198 marks or \$40,299 was for coal.

B.—Street Draining and Water Supply for Sewers, Salaries, etc., 108,118 marks; Running Expenses, 129,470 marks, of which 68,950 marks or \$17,237 was for water. Total, 606,766 marks or \$151,691.

The *rieselfelder* yield an income, though they do not pay current expenses. Prison labor is employed on the fields; five hundred and twenty prisoners having been thus employed last year.

In the Osdorf *rieselfelder*, which appear to be the most productive, the total receipts during the last year were 215,955 marks or \$53,988, while the total expenditures were 216,517 marks or \$54,129, or an excess of \$141 over the receipts.

Altogether the system as we observed it made a favorable impression. At only one place was there any unpleasant evidence of the work that was going on. This was at the overflow basin adjoining the stand-pipe in the fields, but it was not excessive.

Public opinion upon the system is somewhat divided in Berlin, a fear being entertained that in time the *rieselfelder* will be obnoxious. At present, however, there is every appearance of success, and the fact that the system has grown with the new growth of the city, (for Berlin, now numbering 1,200,000 inhabitants, is said to have increased its population one third since 1870) and is still being extended, is proof that the authorities regard it favorably.

Old Germans returning from America after ten or twenty years absence express surprise at the wholesome change wrought in the sanitary condition of the city, and it is claimed that the health of the sections in which it

has supplanted the old cess-pool system, has been improved.

It is considered significant that the river Spree flowing through the city contains many more fish than ever before. Certainly Berlin is a clean city. Rapidity of disposal and without offense are two characteristics of its sewerage system, and water, earth and air all in the greatest abundance seem to solve for it the great sewerage question.

Yet in estimating the positive value of the system, one must not forget the conditions, both adverse and favoring, which led to its adoption in Berlin. In the first place Berlin has no large river to receive its sewage nor is it near the ocean or any large body of water. It is built in the level valley of the river Spree, which flows through a large plain. The city is very flat and on a lower level than the surrounding plain, but the soil of the latter is sandy, making the best sort of ground for the *Rieselfelder* or the filtration of sewage fluid.

These conditions, of course, have had a deciding influence in the selection of a system whose actual value time will do much to demonstrate.

BERLIN, February 10th, 1885.

